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AUTHOR	Armstrong, Roberta A.
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ABSTRACT

Beginning in Fall, 1975, applicants to Liberal Arts, Technology, and Forestry at the University of Minnesota could submit scores on either the Preliminary Scholastic Aptitude Test (PSAT) or the American College Testing Program's aptitude battery (ACT) to satisfy entrance testing requirements. This study determined that new course placement procedures in those areas in which placement was already being done (English, chemistry, and mathematics) could be developed using either test. A multiple regression approach, in which high school performance and aptitude test measures were used to predict course grade in the largest freshman course in each area, was used (i.e., the same procedure as was used to develop the previous placement procedures). PSAT and ACT scores were shown to be useful to about the same degree, and it demonstrated that a combination of high school perfcrmance and test data was more useful than either type of information alone. The resulting placement formulas are computationally different for each area but consist of five equations for each: (1) high school rank plus PSAT scores, (2) high school rank plus ACT scores, (3) four high school average grades plus PSAT scores, (4) four high school average grades plus ACT scores, and (5) a relevant ACT score alone. The new placement cutoff scores were developed through equipercentile equating with the most satisfactory of the old placement equations (ACT and four high school grades) in each area. The resulting placement system is presented. Limitations of the apprcach used were discussed and suggestions for further research were made. (Author/RC)

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The Development of Freshman English, Chemistry, and Mathematics Course Placement Procedures for Fall, 1975 Freshmen (University of Minnesota, Twin Cities Campus)

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Roberta A. Armstrong

A&R Data Retrieval Center
Office of Admissions and Records

Abstract

Beginning in Fall, 1975, applicants to Liberal Arts, Technology, and Forestry (Twin Cities campus) could submit scores on either the Preliminary Scholastic Aptitude Test (PSAT) or the American College Testing Program's aptitude battery (ACT) to satisfy entrance testing requirements. This study determined that new course placement procedures in those areas in which placement was already being done (English, chemistry, and mathematics) could be developed using either test. A multiple regression approach, in which high school performance and aptitude test measures were used to predict course grade in the largest freshman course in each area, was used (i.e., the same procedure as was used to develop the previous placement procedures). PSAT and ACT scores were shown to be useful to about the same degree, and it was demonstrated that a combination of high school performance and test data was more useful than either type of information alone. The resulting placement formulas are computationally different for each area but consist of five equations for each: (a) high school rank plus PSAT scores, (b) high school rank plus ACT scores, (c) four high school average grades plus PSAT scores, (d) four high school average grades plus ACT scores, and (e) a relevant ACT score alone. The new placement cutoff scores were developed through equipercentile equating with the most satisfactory of the old placement equations (ACT and four high school grades) in each area. The resulting placement system has four categories in English (exempt, possible exemption, Comp 1001, and Comp 0001), two in chemistry (yes, take chemistry as an incoming freshmen; no, defer chemistry until the completion of additional mathematics), and eight in mathematics (ranging from accelerated calculus to remedial work). Limitations of the approach used were discussed and suggestions for further research were made.

TM006 048

In 1973 the University of Minnesota announced a change in admissions testing requirements to become effective for all applicants seeking Fall, 1975 admission. For these students, either of two aptitude tests would be accepted for admissions purposes: (a) the National Merit Scholarship Qualifying Test/Preliminary Scholastic Aptitude Test (PSAT), or (b) the American College Testing Program's aptitude test battery (ACT). The former is a relatively short test yielding verbal and mathematics scores ranging from 20 to 80 and is usually taken in the student's high school junior year. The latter, which has four subtests (English, mathematics, social studies reading, and natural sciences reading), is generally taken in the senior year in high school; in addition to the four subtest scores with a range from 1 to 36, a composite score, the average of the four subtests, is reported. Prior to the change in testing requirements, freshman-admitting colleges which required tests primarily used the Minnesota Scholastic Aptitude Test (MSAT), a test of verbal aptitude, for admissions purposes, but recommended ACT for course placement.

This shift from a single admissions test to two different tests was the impetus to the initiation of a large-scale research project. The project, begun in the fall of 1973, had two primary goals. First, new admissions standards needed to be developed based on either of the new tests, and second, course placement procedures based on either test were also needed since we did not want to require that any applicant take more than one test.

The admissions standards project took immediate priority, since the University has for many years published its admissions standards well in advance of application deadlines as a convenience for high school

counselors and prospective applicants. The results of this portion of the research are available in an earlier report (Armstrong, 1975).

Course placement for freshmen at the University has traditionally been done in three subject matter areas--English composition, mathematics, and chemistry. When the placement study was initiated in 1974, the placement procedures in use had been developed about 10 years previously, although they had been re-evaluated on 1971 freshmen (Pazandak, 1972). Before describing the project to develop new procedures, a brief summary of the then current procedures in each subject area will be given to provide a baseline.

English

In several University colleges students are required to complete a freshman composition requirement (or may be exempted from the requirement depending on their writing ability). Three alternative equations based on multiple regression studies were in use to place students in composition. They were used in a specific ranked order, based on the amount and type of information available on the student. A classification of 1, 2, or 3 was assigned based on the student's index value for the appropriate equation. The equations were originally developed on the largest freshman English course available for study (now Comp 1001). Predicted grade point averages (GPAs) for students in this course (based on high school grades and test scores) were related to their subsequent course performance, and cutting scores on the predicted GPA were selected such that a maximum number of students who did poorly in the course could have been excluded without eliminating too many students who performed successfully. Students below this cutoff were assigned to a more basic course; those with

particularly high predicted GPAs were exempted entirely from the requirement or encouraged to test out of it (via an essay or objective examination); and the remainder were encouraged to enroll in the regular sequence (Composition, Communication, or Rhetoric).

Chemistry

A predicted mathematics GPA based on high school grades was computed and a "Y" or "N" classification assigned. Y (yes) indicated that the student may register for the beginning quarter of the chemistry sequence as an entering freshman; N (no) indicated that the student should complete at least one quarter of mathematics (as recommended by the mathematics placement) before beginning the chemistry course.

Mathematics

As in English, the placements hinged on the value of a predicted GPA, computed from whichever of the two available equations was appropriate for the student. Cutoff scores were used in combination with the number of high school math units (years of study) to yield a placement into one of nine categories, ranging from additional information needed to a need for remedial work to permission to register in accelerated courses.

Appendix A shows the precise classification scheme for each area for freshman entering in Fall, 1974. A more detailed summary of the past placement techniques in English composition may be found in Hendel (1972).

The planning of the placement research project was under the author's direction; however, the input of many individuals was helpful in developing the overall plan.[1] By the fall of 1974, a research proposal, described in

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[1]Special thanks are due to Kaustubh Lele and Jim Preus (Admissions & Records), Carol Pazandak (Liberal Arts), Julie Carson (Freshman Composition), Paul Cartwright (Technology), Archie Wilson and Bob Brasted (Chemistry), and Howard Jenkins and Jim Thompson (Mathematics).

the next section, had been prepared and accepted in principle.

General Plan of the Study

The general purpose of the study was development of new placement procedures in freshman English, mathematics, and chemistry to be implemented for Fall, 1975 entering freshmen.

A multiple regression technique, in which predictor variables are related to a criterion (i.e., a course grade), was selected. One of the reasons for selecting this approach was that campus personnel with whom we would be dealing on the development of new placements were more familiar with this than other methods. Thus, even though a more sophisticated statistical approach might have proven more productive, communicating with decision makers was facilitated through use of the more traditional technique.

For each area in which new placements were desired, the largest course was selected for the primary focus of the analysis; in English this is Composition 1001, in Mathematics 1211 and in Chemistry 1004. Fall, 1973 freshmen who took any of these courses during the Fall, Winter, or Spring term of 1973-1974 were included in the analysis. In each area, we selected the first course in each area taken by the student. Although combining data for several terms adds some complicating factors (e.g., different grading practices), it was considered necessary to obtain enough subjects who had PSAT scores available in their files.

For each student in the sample, the following data elements were drawn from Admissions and Records computer files: high school percentile rank (HSR), ACT scores, high school average grades in English, mathematics,

natural science, and social science, MSAT raw score and college-bound percentile, sex, college, and high school academic GPA. PSAT scores were obtained by matching student data in our files with a computer tape of PSAT scores from Educational Testing Service.

Based on previous research on course placement at the University, four sets of multiple regression analyses (those likely to yield the best results) would be run:

1. The combination of high school average grades in four areas and four ACT subtest scores with course grade,
2. HSR and four ACT subtest scores with course grade,
3. High school average grades and PSAT verbal and mathematics scores with course grade, and
4. HSR and PSAT verbal and mathematics grades with course grade.

Given that the total number of subjects with PSAT scores available was quite small, we planned to use the combinations including ACT scores as our primary equations, with those involving PSAT available as backups.

The results of the multiple regression analysis would be used to calculate a placement index (basically the course predicted grade multiplied by 100); cutoff scores would be selected on these indices in consultation with the appropriate departments to yield course placements. The placements, along with other information (e.g., equation used, index value) would be reported to the student and counselor on the Summary of Freshman Admission Data Form which is printed for each entering freshman.

The actual procedures for developing placement information in each subject matter area are presented in the following sections, for English composition, chemistry, and mathematics respectively.

English Composition

As stated earlier, the primary focus of the development process was on the largest freshman course in each area. In composition, this is Comp 1001; an alternative course to this one, Communication 1001, was also studied to provide us with some comparative information on students electing one course over the other.

Basic data available to us for the English project are shown in Table 1. There is virtually no difference in aptitude test and performance measures between students electing Comp 1001 and Comm 1001. Overall, we had a relatively large sample on which to base further analyses; 1,145 students had received a course grade of A through D in Comp 1001 and thus could be included in the correlation and regression studies to be done next. Unfortunately, of the approximately 2,300 students taking Comp 1001 during Fall of 1973 or Winter or Spring of 1974, only about 25% had PSAT scores available. ACT coverage was quite general, however.

The next step in the analysis was to study the relationship of each of the variables to the student's grade in the course. Accordingly, Pearson correlation coefficients were calculated for these variables by course; the resulting values[2] are shown in Table 2. In most research of this kind, correlations (rs) of around .40 are considered useful. It should be pointed out that even a correlation of .40 accounts for only 16% of the variability of the correlated variables. However, in Comp 1001, our major focus, correlations do not exceed .28 and are especially low

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[2] Pearson correlation coefficients range from -1.00 to +1.00. A value of 1.00 indicates a perfect relationship, with a particular high score on one variable always associated with a particular high score on the other; a -1.00 coefficient is the same degree of relationship, but in this case a high score on one variable is associated with a low score on the other. A correlation of zero indicates no relationship between the two variables.

Table 1

Means, Standard Deviations, and Number of Cases for Variables in Comm 1001 and Comp 1001 for Fall, 1973 Freshmen

Variable	Comm 1001			Comp 1001		
	Mean	SD	N	Mean	SD	N
HSR	78.0	17.7	535	78.1	17.1	2,174
High school GPAs:						
English	3.2	.6	552	3.2	.6	2,257
Mathematics	2.9	.8	544	2.9	.8	2,230
Social science	3.3	.6	543	3.2	.6	2,207
Natural science	3.0	.7	528	3.1	.7	2,145
Academic	3.1	.5	559	3.2	.7	2,317
MSAT:						
Raw score	45.4	9.1	524	45.2	9.2	2,097
College-bound percentile	70.6	19.2	524	70.1	19.6	2,097
ACT:						
English	21.4	3.3	556	21.5	3.1	2,233
Mathematics	25.2	5.5	556	25.2	5.6	2,233
Social studies	24.4	4.8	556	24.2	4.9	2,233
Natural science	26.1	5.0	556	26.4	4.8	2,233
Composite	24.4	3.6	556	24.5	3.6	2,233
PSAT:						
Verbal	46.2	10.9	135	48.1	8.6	542
Mathematics	52.9	11.8	135	54.6	10.3	542
Fall 1973 University GPA	2.7	.7	541	2.8	.7	2,270
Course grade	2.8	.8	374	3.0	.7	1,145

Note. Course grade Ns include only students who received A through D grades, thus the Ns are sometimes smaller than those for other variables in the course.

Table 2

Correlations of Predictors with Course Grade
in Comm 1001 and Comp 1001 for
Fall, 1973 Freshmen

Variable	Comm 1001		Comp 1001	
	r	N	r	N
HSR	.31	358	.26	1,069
High school GPAs:				
English	.32	369	.27	1,114
Mathematics	.25	366	.18	1,092
Social science	.29	366	.21	1,084
Natural science	.33	356	.20	1,046
Academic	.36	374	.22	1,144
MSAT:				
Raw score	.28	351	.24	1,022
College-bound percentile	.26	351	.24	1,022
ACT:				
English	.21	372	.28	1,096
Mathematics	.16	372	.15	1,096
Social studies	.24	372	.21	1,096
Natural science	.20	372	.13	1,096
Composite	.26	372	.23	1,096
PSAT:				
Verbal	.44	102	.13	262
Mathematics	.29	102	.10	262

Note. Course grades other than A through D are not included in this analysis.

for PSAT verbal and mathematics. Given the small size of the PSAT group (N = 262) and its known bias (the PSAT group, as reported in Armstrong [1975], has higher HSR and ACT scores), it is not surprising to find a low relationship between PSAT and course grade. Some of the highest correlations with grade found here are, in order: ACT English, high school English GPA, HSR, ACT composite, and high school academic GPA. MSAT correlations are of the same magnitude but of less interest because these scores would not be available for Fall, 1975 entering freshmen. Overall, the relationships are not particularly strong, although some increase could be expected using a combination of variables to predict grade. Some possible reasons for the low correlations are:

1. Effectiveness of current placement strategies,
2. Unreliability of course grades (e.g., variability due to instructor grading practices), and
3. Lack of validity of grades as an indicator of learning (i.e., grades may be contaminated with some subjective factors).

The present data do not present easy answers to this problem; perhaps to some extent all the explanations are operable. We decided to proceed to the next part of the analysis, that of using combinations of variables to predict course grade, since the previous admissions study had found this to be more effective.

Table 3 gives the multiple correlations (Rs) of 13 potential sets of predictors with Comp 1001 grades; HSR and ACT composite statistics from Table 2 are included for reference. As expected, the size of the correlations increases somewhat by using sets of predictors; combinations of test and high school performance data are more effective than either alone. While

Table 3

Multiple Correlations of Selected Predictor Sets
with Comp 1001 Grade for
Fall, 1973 Freshmen

Predictor set	Comp 1001 R	Comp 1001 N
HSR[a]	.26	1,069
HSR, PSAT verbal, PSAT mathematics	.33	261
HSR, ACT composite	.30	1,047
HSR, ACT English, ACT mathematics, ACT social studies, ACT natural science	.36	1,047
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA	.29	986
High school English GPA, high school mathematics GPA, high school social sicence GPA, high school natural science GPA, PSAT verbal, PSAT mathematics	.38	230
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT composite	.33	965
High school GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT English, ACT mathematics, ACT social studies, ACT natural science	.37	965
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA	.30	942
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, PSAT verbal, PSAT mathematics	.39	229
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT composite	.34	923
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT social studies, ACT natural science	.38	923
PSAT verbal, PSAT mathematics	.14	262
ACT composite[a]	.23	1,096
ACT English, ACT mathematics, ACT social studies, ACT natural science	.30	1,096

Note. These multiple correlations are the result of a series of multiple regression analyses in which A-D course grade was predicted using various sets of variables which may be available at the time of admission.

[a]Pearson correlations are reported.

we could wish for stronger relationships, several correlations are around .40, which would permit us to make better decisions with the data than without.

At this point in the project (about March, 1974), we had to decide whether to go ahead and develop new placement criteria using the data available to date, or attempt to study the placement problem in more depth. Ideally, we would have chosen the latter approach, but time was pressing and the former method was selected.

A first step was the examination of the current placement equations. Table 4 shows how 1973 admitted freshmen were distributed among the three available classifications. Only 3.3% of Twin Cities campus freshmen (excluding General College students) were exempted from freshman composition; twice as many, but only 6.4%, were placed in the remedial course. This distribution was reviewed and the results of a survey the English composition administration had made of their instructors were discussed. The survey suggested that most instructors believed that more students should have been exempted and more should have been placed in the remedial course. Based on these data, it was decided to use a placement system with four categories (plus an insufficient information group). These categories are described in Table 5, along with the proportion of 1973 freshmen to be placed in each group. (All cutting scores would be developed on the Fall, 1973 group and then applied to Fall, 1975 entering freshmen. Information on the distribution of these placements for Fall, 1975 freshmen would be provided to composition at various points during the admission process to aid course scheduling.)

Table 4

Distribution of Freshman English Classifications
for Fall, 1973 Admitted Freshmen

Classification	Technology		Liberal Arts		All Twin Cities except General College	
	N	%	N	%	N	%
1 (Exempt)	29	4.7	136	3.2	179	3.3
2 (Comp 1001)	563	90.4	3,824	90.2	4,873	90.3
3 (Comp 0001)	31	5.0	278	6.6	346	6.4
Total classified	623	100.1	4,238	100.0	5,398	100.0

Table 5

Planned Freshman English Classifications for
Fall, 1975 Freshmen

Classification	Description	Proportion of freshmen[a]
1	Exempt from freshman English	Top 5%
2	Possible exemption--student encouraged to take Minnesota English Test	Next 5%
3	Comp 1001 or Comm 1001	Middle 80%
4	Comp 0001	Bottom 10%
5	Insufficient information	---

[a]Based on Twin Cities freshmen (excluding General College), Fall, 1973.

The data presented in Table 3 suggested that several sets of criteria potentially available at the time of admission could predict Comp 1001 grade fairly well. These are listed in Table 6 in order of preference, which was determined by the following criteria:

1. Quality of the data--All other things being equal, the predictor set with the largest number of cases available during the analyses was selected first since it was likely to be more reliable and valid.
2. Correlation of predictor set with course grade--All other things being equal, the predictor set which correlated best with course grade would be selected first.

Thus, for the student with all four high school GPAs and ACT, predictor Set 1 would be used. If one or more GPAs were missing but the student had ACT and HSR, Set 2 would be used, and so forth. It was hoped that the availability of a number of sets would permit classification for the maximum number of freshmen, since all applicants would not have exactly the same data available.

Each predictor set may be used to compute an English classification "index," which will be referred to as Index 1 (based on Set 1), Index 2 (based on Set 2), and so forth. Indices 1 through 5 are basically the predicted grade in Comp 1001 multiplied by 100 and as such may theoretically range from 0 to 400. (We refer to these values as indices, however, because with inflating GPAs at the University, predicted GPAs soon look low and also because measurement error is such that an A grade is not predicted for any student.) Index 6 is ACT English standard score alone and ranges

Table 6

Computational Information for English Classification Indices 1 through 6
for Fall, 1975 Freshmen

Index	Average high school grades				HSR	ACT				PSAT		Constant	Valid values
	English	Math	SocSc	NatSci		E	M	SS	NS	Verb	Math		
1	+23.4	+2.35	+4.67	+1.84		+4.65	+.79	+1.1	-1.14			+81.0	0-400
2					+.90	+4.78	+.27	+1.77	-1.13			+107.35	0-400
3	+38.7	+14.3	+13.3	-1.99						+.13	-.11	+89.8	0-400
4					+1.78					+.42	-.40	+156.31	0-400
5	+26.77	+6.57	+5.66	+4.31								+164.8	0-400
6						+1.00							1-36

Note. This table may be used to compute English classification indices. The equations are listed in order of preference. Each variable is multiplied by the appropriate coefficient and the resulting values and the constant are summed to yield the index; for example,

Index 4 = 1.78 X HSR + .42 X PSAT verb - .40 X PSAT math + 156.31

High school grades are the average of grades in each area; for example, if a student has an A in English as a junior and a B as a senior, his or her English GPA would be 3.5 (assuming both were full year courses). In these calculations A is 4 grade points, B is 3, C is 2, D is 1, and F is 0, and P/N grades are excluded. Grades from 10th, 11th, and 12th grades are included if available.

from 1 to 36. Information necessary for the calculation of each of these indices may also be found in Table 6.

To determine appropriate cutting scores for each classification and for each of the new indices, the following procedure was followed. First, the appropriate cutting score on the most frequent current English placement equation[3] was found. This was done using a sample of 3,643 Twin Cities freshmen (again excluding General College) for whom this value (a predicted English GPA, referred to hereafter as Eng Old) could be calculated. Values of Eng Old which cut off the percentages of students desired (Cf. Table 5) were identified for this group of Fall, 1973 freshmen. It should be noted that a relatively large number of freshmen are missing from this group since they lacked the variables necessary to calculate Eng Old. Therefore, to use these data as our base, we must assume that this group is reasonably representative of Fall, 1973 freshmen; there do not appear to be any obvious reasons why they would be radically different. The Eng Old values corresponding to our new placement classifications are shown in Table 7. If we decided to exempt Fall, 1975 freshmen from freshman English on the basis of Eng Old, all those with Eng Old values of 2.56 or above would be excused from the requirement. However, we wish to set cutting scores for these classifications for Indices 1 through 6; to do this the Index 1 through 6 values equivalent to the Eng Old cutoffs must be determined. Equipercentile equating was used to determine these equivalent values; the procedure is illustrated by a description of the process used to determine Eng Old and Index 1 equivalents. A sample of students for whom both

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[3] Eng Old = (.065 X ACT English + .001 X ACT mathematics + .032 X ACT social studies - .001 X ACT natural science - .168 + .153 X high school English grade + .180 X high school mathematics grade + .156 X high school social science grade + .123 X high school natural science grade + .280)/2.

Table 7

Equivalent Cutoff Scores for Eng Old and Indices 1 through 6
for Fall, 1975 Freshman English Classifications

Classification	Percentage of Fall, 1973 freshmen	Eng Old	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6
1	Top 5%	2.56+	350+	346+	347+	333+	340+	27+
2	Next 5%	2.45-2.55	338-349	335-345	338-346	328-332	332-339	25-26
3	Middle 80%	1.65-2.44	250-337	247-334	232-337	230-327	258-331	15-24
4	Bottom 10%	1.64 and below	249 and below	246 and below	231 and below	229 and below	257 and below	14 and below

Note. Information needed to calculate Indices 1 through 6 is contained in Table 6.

Eng Old and Index 1 could be computed was selected; each student, then, had all four high school GPAs and all four ACT scores. Every member of the sample was a Fall, 1973 freshman who had taken either Comm 1001 or Comp 1001 during his or her freshman year. Two cumulative frequency distributions--one for Index 1 and one for Eng Old--were obtained for this group of 2,475 freshmen. These two distributions were each plotted on graph paper (index value by cumulative percentage, Eng Old by cumulative percentage) and the values were connected by a smooth curve. The equipercentile equating procedure assumes that a student receiving an Eng Old at a certain percentile in this group would be expected to receive an Index 1 value at the same percentile in this group. To determine the equivalent of an Eng Old of 2.56 (the cutoff for exemption), we note that this value appears at the 98th percentile; the value of Index 1 at the 98th percentile is 350. These two values may be considered equivalent. In a similar manner, the other Eng Old Index 1 equivalents were found. Cutoff values for Indices 2 through 6 were found by equating them to Index 1 cutoffs using the procedure already described. Each of these new cutoff values may be found in Table 7.

Following the acceptance of the new system by the Freshman composition administration, the necessary instructions were forwarded to the Administrative Data Processing Department so that the new placement data could be incorporated into each admitted freshman's record.

In the summer of 1975, a distribution of admitted freshmen into each of the new categories was prepared to aid in planning and to provide a preliminary estimate of the effectiveness of the new strategy. These data are displayed in Table 8. As planned, about 10% of the incoming

Table 8

Distribution of Freshman English Classifications
for Fall, 1975 Admitted Freshmen
as of July 16, 1975

Classification	Technology		Liberal Arts		All Twin Cities except General College	
	N	%	N	%	N	%
1 (exempt)	52	6.1	193	4.5	263	4.5
2 (test)	67	7.9	232	5.4	335	5.8
3 (Comp 1001)	706	82.9	3,575	82.9	4,794	82.8
4 (Comp 0001)	27	3.2	311	7.2	395	6.8
Total classified	852	100.1	4,311	100.0	5,787	99.9
Not classified	21		78		118	
Total admitted	873		4,389		5,905	

Note. 118 unclassified students represent 2.0% of total students admitted to date.

student group were potentially exempt; slightly fewer than desired were placed in the remedial category. Overall, 98% of the incoming freshman group were classified into one of the four available categories.

Chemistry

As in the English project, our primary efforts toward chemistry placement focused on the largest freshman introductory course in this area, Chem 1004; some data were also collected on Chem 1031, an introductory course intended for chemistry majors. Basic characteristics for students in these two courses are shown in Table 9. As might be expected, students in Chem 1031 have a generally stronger background in math and the natural sciences, as measured both by high school performance and by test scores. A fairly large sample of around 800 students was available for study, although only about a third of them had PSAT scores available.

Next we examined the relationship of each variable to course grade via Pearson correlations, which are shown in Table 10. In Chem 1004, the correlations are, overall, somewhat higher than those seen for Comp 1001. The best predictors are indicative of math ability and performance--high school mathematics GPA, ACT mathematics standard score, and PSAT mathematics score. HSR, high school natural science and academic GPA, and ACT composite score also correlate highly. The patterns of correlation in Chem 1031 are similar, although some unexpected differences (e.g., high school academic GPA correlation of .11) are probably due to restriction in range in both course grade and high school grades for this group.

Table 11 gives the result of a multiple correlation analysis for Chem 1004 students. The multiple correlations (Rs) are considerably

Table 10

Correlations of Predictors with Course Grade
in Chem 1004 and Chem 1031 for
Fall, 1973 Freshmen

Variable	Chem 1004		Chem 1031	
	r	N	r	N
HSR	.39	749	.30	127
High school GPAs:				
English	.26	769	.21	124
Mathematics	.44	773	.39	127
Social science	.29	754	.25	125
Natural science	.39	761	.37	127
Academic	.38	783	.11	134
MSAT:				
Raw score	.37	679	.36	119
College-bound percentile	.34	679	.34	119
ACT:				
English	.30	764	.29	125
Mathematics	.44	764	.40	125
Social studies	.27	764	.42	125
Natural science	.26	764	.37	125
Composite	.40	764	.45	125
PSAT:				
Verbal	.31	238	.26	49
Mathematics	.41	238	.43	49

Note. Course grades other than A through D are not included in this analysis.

Table 9

Means, Standard Deviations, and Number of Cases for Variables in Chem 1004 and Chem 1031 for Fall, 1973 Freshmen

Variable	Chem 1004			Chem 1031		
	Mean	SD	N	Mean	SD	N
HSR	83.9	14.6	821	88.0	13.1	161
High school GPAs:						
English	3.3	.6	842	3.3	.6	160
Mathematics	3.2	.7	845	3.6	.5	163
Social science	3.4	.6	827	3.5	.6	161
Natural science	3.3	.7	831	3.6	.5	163
Academic	3.3	.6	856	3.6	.9	171
MSAT:						
Raw score	46.6	10.2	746	48.0	10.4	151
College-bound percentile	72.6	20.3	747	75.0	20.2	151
ACT:						
English	22.1	3.7	837	22.0	3.7	158
Mathematics	27.6	4.0	837	30.4	3.6	158
Social studies	25.2	4.8	837	26.2	4.7	158
Natural science	27.9	4.1	837	30.2	3.3	158
Composite	25.8	3.3	837	27.3	3.1	158
PSAT:						
Verbal	49.6	8.3	254	47.5	14.0	56
Mathematics	57.3	8.1	254	58.0	15.9	56
Fall 1973 University GPA	2.9	.6	845	2.9	.6	154
Course grade	2.6	.9	783	2.8	.8	134

Note. Course grade Ns include only students who received A through D grades, thus the Ns are sometimes smaller than those for the other variables in the course.

Table 11

Multiple Correlations of Selected Predictor Sets with Chem 1004 and Chem 1031 Grade for Fall, 1973 Freshmen

Predictor Set	Chem 1004 R	Chem 1004 N	Chem 1031 R	Chem 1031 N
HSR[a]	.39	749	.30	127
HSR, PSAT verbal, PSAT mathematics	.49	234	.47	49
HSR, ACT composite	.49	740	.47	125
HSR, ACT English, ACT mathematics, ACT social studies, ACT natural science	.52	740	.49	125
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA	.48	732	.45	122
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, PSAT verbal, PSAT mathematics	.54	227	.50	47
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT composite	.54	722	.52	121
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT English, ACT mathematics, ACT social studies, ACT natural science	.55	722	.55	121
HSR, high school English GPA, high school mathematics GPA, high school social science GPA high school natural science GPA	.48	707	.45	122
HSR, high school English GPA, high School mathematics GPA, high school social science GPA, high school natural science GPA, PSAT verbal, PSAT mathematics	.54	233	.50	47
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT composite	.54	701	.52	121
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT English, ACT mathematics, ACT social studies ACT natural science	.55	701	.55	121
PSAT verbal, PSAT mathematics	.43	238	.44	49
ACT composite[a]	.40	764	.45	125
ACT English, ACT mathematics, ACT social studies, ACT natural science	.46	764	.47	125

Note. These multiple correlations are the result of a series of multiple regression analyses in which A through D course grade was predicted using various sets of variables which may be available at the time of admission.

[a]Pearson correlations are reported. Variables are included in the regression only if they add significantly to the correlation; this set does not include ACT English.

higher than the Pearson correlations shown in Table 10. Either test data or high school data alone are not nearly as good a predictor as a combination of the two types of information, and both ACT and PSAT appear to be equally good in combination with high school information.

These preliminary results were discussed with staff in the Chemistry Department. It was decided to go ahead with developing new placement categories using the data on Chem 1004. The effectiveness of the current placements into chemistry was also reviewed, and satisfaction was expressed with the ability level of students entering Chem 1004 as freshmen. Table 12 shows the current placement system, which consists of only two categories; most (58%) 1973 freshmen were permitted to take Chem 1004 if they wished.

A similar procedure to that used in developing new English placements was followed for chemistry. Six alternative formulas were established for the computation of placement indices. Table 13 lists the sets in their order of preference, along with their correlation with course grade and the number of cases on which the correlations were based. Computational information for each index is given in Table 14.

The equipercentile equating method described in the section on English placement was used to determine values on each of the new indices equivalent to the cutoff scores on the primary old classification equation (Chem Old).[4] The results of this process are given in Table 15.

Table 16 shows a distribution of the classifications for Fall, 1975 admitted freshmen; it is virtually identical to that shown in Table 12.

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[4] Chem Old = (.0480 X ACT English + .0656 X ACT mathematics + .0167 X ACT social studies - .0110 X ACT natural science - .8868 + .0793 X high school English grade + .3555 X high school math grade + .1246 X high school social studies grade + .1374 X high school natural science grade + .0153)/2.

Table 12

Distribution of Chemistry Classifications
for Fall, 1973 Twin Cities Freshmen

Classification	Liberal Arts		All Twin Cities except General College	
	N	%	N	%
Y (may take Chem 1004 as a freshman)	2,119	57.2	2,429	57.6
N (may not take Chem 1004 as a freshman)	1,585	42.8	1,791	42.4
Total classified	3,704	100.0	4,220	100.0

Table 13

Best Predictors of Chem 1004 Grade, Correlations of Predictors with Course Grade, and Number of Cases on which Data are Based for Fall, 1973 Freshmen

Set number	Variables in set	R	N
1	High school English GPA High school mathematics GPA High school social science GPA High school natural science GPA ACT English ACT mathematics ACT social studies ACT natural science	.55	722
2	HSR ACT English ACT mathematics ACT social studies ACT natural science	.52	740
3	High school English GPA High school mathematics GPA High school social science GPA High school natural science GPA PSAT verbal PSAT mathematics	.54	227
4	HSR PSAT verbal PSAT mathematics	.49	234
5	High school English GPA High school mathematics GPA High school social science GPA High school natural science GPA	.48	732
6	ACT mathematics	.44[a]	764

Note. High school grades are the average of all grades received in that area in 10th, 11th, and 12th grade.

[a]Pearson correlation is reported.

Table 14

Computational Information for Chemistry Classification
Indices 1 through 6 for Fall, 1975 Freshmen

Index	Average high school grades				HSR	ACT				PSAT		Constant
	English	Math	SocSt	NatSci		E	M	SS	NS	Verb	Math	
1	-5.87	+27.56	+10.21	+19.03		+1.53	+5.52	+.93	+.59			-136.57
2					+1.51	+1.57	+7.11	+.86	+.59			-140.48
3	-14.21	+38.33	+23.50	+7.51						+1.05	+2.99	-144.13
4					+1.77					+1.23	+2.98	-117.87
5	-6.49	+41.20	+13.29	+26.22								+154.86
6							+1.00					

Note. Information contained in this table may be used to compute chemistry classification indices. The equations are listed in order of preference. Each variable is multiplied by the appropriate coefficient and the resulting values and the constant are summed to yield the index; for example,

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Index 4 = +1.77 X HSR + 1.23 X PSAT verb + 2.98 X PSAT math - 117.87

High school grades are the average of grades in each area in the 10th through 12th grades (or as much available at the time of application). In these calculations, A is 4 grade points, B is 3, C is 2, D is 1, and F is 0; P/N grades are excluded. Valid values for indices 1 through 5 are zero through 400; for Index 6, valid values range from 1 to 36.

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Table 15

Equivalent Cutoff Scores for Chem Old and Indices 1 through 6
for Fall, 1975 Freshmen Chemistry Classifications

Classification	Chem Old	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6
Y (may take Chem as freshman)	1.9+	214+	211+	221+	215+	220+	24+
N (may not take Chem as a freshman)	Below 1.9	Below 214	Below 211	Below 221	Below 215	Below 220	Below 24

Note. Information needed to calculate Indices 1 through 6 is contained in Table 14.

Table 16

Distribution of Chemistry Classifications for
Fall, 1975 Admitted Freshmen as of July 16, 1975

Classification	Liberal Arts		All Twin Cities except General College	
	N	%	N	%
Y	2,200	51.0	3,295	56.9
N	2,111	49.0	2,491	43.0
Total classified	4,311	100.0	5,786	99.9
Not classified	78		118	
Total admitted	4,389		5,904	

Note. The 118 unclassified students represent 2% of total students admitted.

Again, we were able to classify 98% of the incoming freshmen, thus eliminating most hand calculation of placements.

Mathematics

Placement research in mathematics is based primarily on Math 1211, selected as a "typical," large-enrollment freshman course in calculus; it is the first course of a three-course sequence. As Table 17 shows, a number of other mathematics courses which could be first courses at the University were studied as well:

Math 1008	Trigonometry
Math 1111	College Algebra and Analytic Geometry
Math 1142	Introduction to Calculus
Math 1201	Pre-Calculus
Math 1211	Analysis I (calculus)
Math 1311	Computer Calculus I
Math 1611	Analysis I (accelerated calculus course)

These are arranged in the table in order of prerequisite requirements and, to some extent, student ability required. Values of the variables included in the table reflect this dimension (e.g., HSR, ACT mathematics standard score). There is not, however, a striking progression in terms of course grade.

Table 18 gives the Pearson correlations between each predictor and course grade by course. For each course, the highest correlations generally involve high school mathematics GPA, ACT mathematics score, and PSAT mathematics score. Correlations of other predictors with course grade are disappointingly low. To some extent, this suggests that the current placement criteria are working fairly well; students within each course are quite similar.

Table 17

Means, Standard Deviations, and Number of Cases for Variables in Math 1008, Math 1111, Math 1142, Math 1201, Math 1211, Math 1311, Math 1611 for Fall, 1973 Freshmen

Variable	Math 1008			Math 1111			Math 1142			Math 1201			Math 1211			Math 1311			Math 1611		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
RSR	66.3	27.8	271	71.9	24.3	739	72.9	23.1	278	70.8	25.3	613	76.3	24.7	1021	80.9	20.6	157	93.0	14.1	217
High school GPAs:																					
English	3.0	.7	265	3.1	.6	725	3.1	.6	272	3.1	.6	605	3.2	.6	990	3.2	.6	156	3.6	.4	211
Mathematics	2.8	.8	263	2.8	.7	721	3.0	.7	274	2.9	.7	605	3.2	.6	998	3.4	.5	156	3.8	.4	216
Social studies	3.1	.7	258	3.2	.7	713	3.2	.6	267	3.2	.7	594	3.3	.6	978	3.3	.6	153	3.7	.4	214
Natural science	2.8	.8	256	3.0	.8	695	3.0	.7	258	3.0	.7	583	3.2	.7	965	3.4	.6	152	3.9	.4	215
Academic	3.0	.7	271	3.1	.7	739	3.1	.7	278	3.1	.7	612	3.3	.7	1020	3.3	.4	157	3.7	.4	217
MSAT:																					
Raw score	43.7	10.1	242	42.7	9.8	659	42.3	9.3	258	43.7	10.3	553	45.8	9.9	899	49.1	9.0	133	54.2	8.8	201
College-bound percentile	66.5	21.9	242	64.8	21.5	660	63.9	21.0	258	66.2	22.3	554	70.7	20.5	899	77.9	16.2	133	86.4	14.0	201
ACT:																					
English	20.7	4.1	264	20.9	3.7	723	20.7	3.4	274	20.6	3.9	587	21.2	3.9	976	22.0	3.4	152	24.7	3.4	208
Mathematics	24.4	4.4	264	24.7	4.4	723	26.2	4.1	274	26.5	4.0	587	28.0	3.4	976	30.0	2.9	152	32.6	2.4	208
Social studies	23.9	5.1	264	23.4	5.2	723	23.6	5.2	274	23.7	5.1	587	24.5	5.2	976	26.4	4.1	152	28.5	3.0	208
Natural science	26.3	4.7	264	25.9	4.7	723	26.3	4.3	274	27.0	4.3	587	27.9	4.1	976	29.8	3.3	152	31.1	2.4	208
Composite	23.3	5.1	271	23.3	4.9	739	24.0	4.4	278	23.6	5.9	613	24.4	6.1	1021	26.3	5.4	157	28.2	6.2	217
PSAT:																					
Verbal	49.6	9.1	43	46.9	8.5	162	46.4	7.8	59	47.3	8.5	104	48.8	8.5	269	49.2	8.8	47	54.8	7.5	95
Mathematics	55.0	7.3	43	52.4	8.2	162	54.9	7.0	59	55.1	8.3	104	57.6	7.9	269	59.6	6.6	47	64.6	6.5	95
Fall 1973 University GPA	2.7	.7	257	2.7	.7	598	2.8	.6	274	2.8	.7	593	2.8	.7	992	2.8	.6	150	3.2	.6	210
Course grade	2.7	.8	166	2.9	.8	598	2.7	1.0	196	2.9	.8	488	2.8	.9	791	2.7	.8	119	3.1	.8	178

Note: Course grade Ns include only students who received A through D grades, thus the Ns are sometimes smaller than those for the other variables in the course.

Table 18

Correlations of Predictors with Course Grade in
Math 1008, Math 1111, Math 1142, Math 1201, Math 1211, Math 1311, Math 1611 for
Fall, 1973 Freshmen

Variable	Math 1008		Math 1111		Math 1142		Math 1201		Math 1211		Math 1311		Math 1611	
	r	N	r	N	r	N	r	N	r	N	r	N	r	N
HSR	.07	166	.20	598	.25	196	.17	488	.13	791	.00	119	.15	178
High school GPAs:														
English	.10	162	.18	590	.15	194	.28	483	.22	763	.04	119	.12	172
Mathematics	.37	163	.34	587	.25	196	.36	484	.29	771	.13	119	.26	177
Social science	.03	158	.18	578	.21	191	.16	477	.15	753	.11	118	.14	176
Natural science	.17	159	.21	565	.18	183	.24	467	.25	747	.26	115	.14	176
Academic	.15	166	.24	588	.30	196	.27	487	.25	790	.18	119	.25	178
MSAT:														
Raw score	.21	151	.16	536	.13	183	.22	443	.21	695	.08	105	.12	164
College-bound percentile	.20	151	.14	537	.11	183	.21	444	.18	695	.04	105	.06	164
ACT:														
English	.15	161	.19	586	.13	196	.20	466	.21	751	.06	114	.11	170
Mathematics	.37	161	.43	586	.15	196	.37	466	.33	751	.25	114	.34	170
Social studies	.13	161	.18	586	.00	196	.14	466	.17	751	.11	114	.11	170
Natural science	.15	161	.16	586	.04	196	.13	466	.13	751	.18	114	.15	170
Composite	.11	161	.23	586	.09	196	.08	488	.06	791	-.10	119	.10	178
PSAT:														
Verbal	.20	34	.12	145	-.11	44	.20	90	.30	229	.07	41	.07	75
Mathematics	.26	34	.40	145	.02	44	.37	90	.34	229	.39	41	.36	75

Note. Course grades other than A through D are not included in this analysis.

The regression analyses done with students in Math 1211 indicate that several sets of predictors can predict course grade reasonably well. These data are given in Table 19. Both ACT and PSAT scores work well; however, HSR is not too useful when compared with all four high school average GPAs. These data were discussed with the Mathematics Department and Technology administration; information on the current mathematics placement system was also analyzed (Table 20). Since satisfaction was expressed with the current system, the remainder of the analyses were devoted to determining new index values equivalent to the old.

Table 21 lists the predictor sets chosen for use in order of preference, which was established using the same criteria as in the English portion of the study. Each set of cutoffs on the new indices was equated to the predominantly used "old" mathematics placement equation, which was based on four high school GPAs and four ACT scores.[5] All students who had completed any of the freshman mathematics courses at the University were used as part of the sample for the equipercentile equating process used to determine the new cutoffs. The procedure used was otherwise the same as that described earlier. The computational formula for each new index is given in Table 22, while Table 23 displays the new placement system as it relates to the old one. This new system was adopted and applied to freshmen admitted for Fall of 1975. The distribution of placements for this group may be found in Table 24 and compared with Table 20, which contains the same distribution for Fall, 1973 freshmen. The two tables are markedly similar. In addition, more students, 98% versus 92%, are classified in the 1975 freshmen group.

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[5]Math Old = (.059 X ACT English + .045 X ACT mathematics + .016 X ACT social studies + .003 X ACT natural science - 1 065 + .107 X high school English grade + .121 X high school mathematics grade + .193 X high school social science grade + .4125 X high school natural science grade - .497)/2.

Table 19

Multiple Correlations of Selected Predictor Sets with Math 1211 Grade for Fall, 1973 Freshmen

Predictor set	Math 1211 R	Math 1211 N
HSR[a]	.13	791
HSR, PSAT verbal, PSAT mathematics	.39	229
HSR, ACT composite	.13	791
HSR, ACT English, ACT mathematics, ACT social studies, ACT natural science	.37	751
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA	.34	720
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, PSAT verbal, PSAT mathematics	.42	215
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT composite	.34	720
High school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT English, ACT mathematics, ACT social studies, ACT natural science	.40	697
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA	.34	720
HSR, high school English GPA, high school mathematics GPA, PSAT verbal, PSAT mathematics	.42	215
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT composite	.34	720
HSR, high school English GPA, high school mathematics GPA, high school social science GPA, high school natural science GPA, ACT English, ACT mathematics, ACT social studies, ACT natural science	.40	697
PSAT verbal, PSAT mathematics	.38	229
ACT composite[a]	.06	791
ACT English, ACT mathematics, ACT social studies, ACT natural science	.35	751

Note: These data are for all 1973 freshmen who took Math 1211 in 1973-74, regardless of whether it was their first course in mathematics.

[a]Pearson correlation is reported.

Table 20

Distribution of Mathematics Classifications
for Fall, 1973 Twin Cities Freshmen

Classification	Technology		Liberal Arts		All Twin Cities (except General College)	
	N	%	N	%	N	%
1--Math 1611 (or 1111, 1131, 1211, or 1311)	153	24.7	378	9.1	567	10.7
2--Math 1211 or 1311 (or 1111 or 1131)	245	39.6	807	19.4	1,181	22.3
3--Math 1201, 1111, or 1131	134	21.7	527	12.7	735	13.9
4--Math 1111, 1131, or 1008	42	6.8	1,005	24.2	1,230	23.2
5--Consult (predicted GPA high for amount of math taken)	6	1.0	185	4.5	203	3.8
6--Math 0009 (a repeat course for the student)	31	5.0	375	9.0	463	8.7
7--Math 0009 (not a repeat course for the student)	7	1.1	844	20.3	892	16.8
8--Student needs elementary algebra	1	.2	36	.9	37	.7
Total classified	619	99.9	4,157	100.1	5,308	100.1
9--Inadequate information for placement decision (i.e., fewer than 9.6 overall high school units)	108		345		486	

Note. Suggested courses for each classification are drawn from the spring, 1975 Liberal Arts memorandum on course placement in arts college freshman courses.

Table 21

Best Predictors of Math 1211 Grade,
Correlations of Predictors with Course Grade, and
Number of Cases on which Data are Based
for Fall, 1973 Freshmen

Set number	Variables in set	Correlation with grade	N
1	High school English GPA High school mathematics GPA High school social science GPA High school natural science GPA ACT English ACT mathematics ACT social studies ACT natural science	.41	482
2	HSR ACT English ACT mathematics ACT social studies ACT natural science	.37	505
3	High school English GPA High school mathematics GPA High school social science GPA High school natural science GPA PSAT verbal PSAT mathematics	.43	172
4	HSR PSAT verbal PSAT mathematics	.39	181
5	High school English GPA High school mathematics GPA High school social science GPA High school natural science GPA	.33	498
6	ACT mathematics	.33	Approx. 500

Note. High school grades are the averages of all grades received in that area in 10th, 11th, and 12th grade (or as many years as are available at the time of admission).

Table 22

Computational Information for Mathematics Classification Indices 1 through 6 for Fall, 1975 Freshmen

Index	Average high school grades				HSR	ACT				PSAT		Constant	Valid values
	English	Math	Soc	NatSci		E	M	SS	NS	Verb	Math		
1	+19.24	+22.71	-12.85	+19.58		+2.59	+7.10	-.59	-1.76			-76.67	0-400
2					+1.10	+3.18	+8.56	-6.45	-1.33			-73.73	0-400
3	+4.78	+36.30	+2.80	+6.63						+1.63	+2.58	-122.07	0-400
4					+.71					+1.74	+2.91	-32.8	0-400
5	+23.9	+30.10	-16.23	+22.19								+85.0	0-400
6							+1.00						1-36

Note. Information contained in this table may be used to calculate mathematics classification indices. The equations are listed in order of preference. Each variable is multiplied by the listed coefficient and the resulting values and the constant are summed to yield an index; for example,

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Index 4 = .71 X HSR + 1.74 X PSAT verbal + 2.91 X PSAT math - 32.8

Each index is then rounded to the nearest whole number. High school grades in this table are the average of grades in each area in the 10th through the 12th grades (or as many as are available at the time of admission). In these calculations, A is 4 grade points, B is 3, C is 2, D is 1, and F is zero; P/N grades are excluded.

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Table 23

Equivalent Cutoff Scores for Math Old and Indices 1 through 6
for Fall, 1975 Freshman Mathematics Classifications

High school math units	Math Old	Classification	Index 1	Index 2	Index 3	Index 4	Index 5	Index 6
<1.00	N/A	8	N/A	N/A	N/A	N/A	N/A	N/A
1.00-2.99	<2.00	7	≤258	≤262	≤247	≤256	≤269	≤26
	≥2.00	5	259+	263+	248+	257+	270+	27+
3.00-3.4	<1.45	6	≤173	≤179	≤173	≤201	≤209	≤19
	1.45-2.55	4	174-331	180-326	174-327	202-322	210-322	20-32
	2.56+	5	332+	327+	328+	323+	323+	33+
>3.4	<1.45	6	≤173	≤179	≤173	≤201	≤209	≤19
	1.45-1.89	3	174-245	180-250	174-232	202-245	210-259	20-25
	1.90-2.39	2	246-309	251-305	233-303	246-298	260-306	26-29
	2.40+	1	310+	306+	304+	299+	307+	30+
<9.6 overall units	N/A	9	N/A	N/A	N/A	N/A	N/A	N/A

Note. Information needed to calculate indices 1 through 6 may be found in Table 22.

Table 24

Distribution of Mathematics Classifications
for Fall, 1975 Admitted Freshmen
as of July 16, 1975

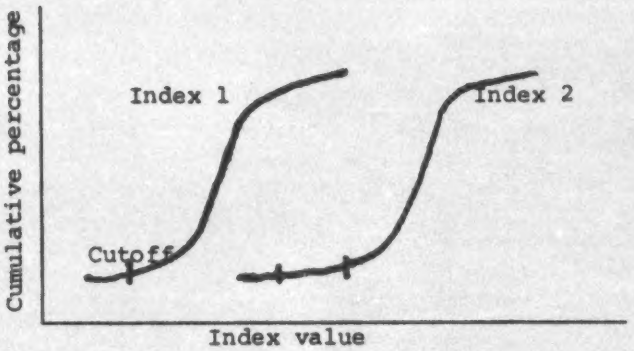
Classification	Technology		Liberal Arts		All Twin Cities except General College	
	N	%	N	%	N	%
1	249	28.7	346	8.0	624	10.8
2	373	42.9	848	19.6	1,308	22.6
3	131	15.1	506	11.7	705	12.2
4	54	6.2	926	21.4	1,186	20.5
5	6	.7	168	3.9	201	3.5
6	30	3.5	472	10.9	565	9.8
7	5	.6	947	21.9	1,046	18.1
8	21	2.4	117	2.7	159	2.7
Total classified	869	100.1	4,330	100.1	5,794	100.2
Not classified	4		60		114	
Total admitted	873		4,390		5,908	

Note. The 114 students not classified represent 1.9% of students admitted to date.

Discussion

The revision of course placement procedures just described was heavily, perhaps too much, dependent on past research. The traditional multiple regression approach is only one of several which might have been used. Yet in order to equate new index values to old, it made sense to use similar statistical procedures, predictor variables, and criterion measures. These latter two factors are also a matter of some concern. Predictors used tend to fall into the aptitude/previous performance domain, and, while, in chemistry and mathematics at least, they do a fairly good job of predicting performance, it would make some sense to more accurately measure a person's precise knowledge in an area via an achievement test before deciding which course, if any, should be taken. For example, in freshman composition, we might use a test of knowledge of writing mechanics to determine which students need to review basic skills before beginning a writing course.

Another difficulty with the project relates to the PSAT/ACT option which students now have. While we did develop equivalent placement procedures based on either test, this was difficult. The PSAT sample available was small and somewhat biased in the direction of higher-ability students. This created some problems with comparison of correlation coefficients across the two samples. However, its most serious problem affects the validity of equated cutting scores at the lower end of the distribution. The equated scores were determined on groups of students for whom both indices could be calculated. In some cases, inspection of pairs of curves did not result in a clear-cut decision on the cutting point. This is illustrated below in a hypothetical example.



Clearly, the equated value on Index 2 could fall within a broad range due to the small number in the sample with scores in that region. The use of two optional tests are likely to continue to cause difficulty for research projects of this nature, both in sheer amount of work required to accomplish the research, as well as in the validity and comparability of decisions made.

Use of five different placement options within each area did have one highly desirable effect--only about 2% of incoming freshmen could not be classified, where under the older system, about 8% remained unclassified.

Several recommendations for future research in the placement area grew out of this project and will be pursued. First, we should investigate alternative placement strategies and methods, in particular tests more specific to the subject matter under study. A focus of such research would be on the effectiveness of achievement tests versus grades/aptitude test variables. Many researchers have found that the latter information, which is usually routinely collected at the time of admission, does as good a job of placing students as do achievement tests, which must be administered in addition to the usual entrance requirements.

Second, we need to consider exemption as a different decision from that placing a student in a remedial course. It is possible that different

strategies are required.

Third, we need to improve the criteria available for student course performance. All the ways to do this require close work with the appropriate University departments before the students to be studied begin instruction. Some options might be a special achievement test at the end of the course, assignment of A through F grades (for research purposes only, of course) to all students regardless of grading system for which they registered, and instructor judgments.

It is clear that much needs to be done in this area. Improved placement can be of great benefit to the University--to the students who are placed appropriately and to the departments and faculty who must make best use of scarce instructional resources.

Reference List

Armstrong, R. A. The development of new admissions standards for Fall 1975 University of Minnesota freshmen. Office for Student Affairs Research Bulletin, 1975, 16(1).

Hendel, D. D. Some issues and alternatives in the placement of University of Minnesota students in freshman English. Admissions and Records Report, Vol. I (1), December 1, 1972.

Pazandak, C. Review of course placement equations for freshman English, mathematics and chemistry: 1964 vs. 1970 and 1971 freshmen. Unpublished manuscript, 1972.

Appendix A

Course Placement Procedures in Effect Prior to Fall, 1975

English

One of three equations was used, depending on which data were available on the student. These are listed below in order, along with the decision made on the basis of the resulting values.

Equation 1. (.065 X ACT English + .001 X ACT mathematics + .032 X ACT social studies - .001 X ACT natural science - .168 + .153 X high school English grade + .180 X high school mathematics grade + .156 X high school social science grade + .123 X high school natural science grade + .280)/2. (Note. Appropriate high school grades are selected as follows: For English, mathematics, and social science, junior-year grade is first choice, senior-year grade second choice, and sophomore-year grade third choice. For natural science, chemistry grade is first choice, followed by physics, biology, and physical science.)

If the resulting value, a predicted GPA in English composition, is greater than 2.60, English classification is "1." If it is between 1.63 and 2.60, the classification is a "2," otherwise classification is a "3."

Equation 2. 4.871363 - .020359 X MSAT raw score -.070439 X ACT English.

If the resulting value is less than 1.55, English classification

is "1." If it is between 1.55 and 3.09, English classification is "2," otherwise it is "3."

Equation 3. 4.724273 - .1061 X ACT English.

If the resulting value is less than 1.70, English classification is "1." If it is between 1.70 and 3.09, classification is "2," otherwise it is "3."

Chemistry

Chemistry placement is done using only one equation: (.0480 X ACT English + .0656 X ACT mathematics + .0167 X ACT social studies - .0110 X ACT natural science - .8868 + .0793 X high school English grade + .3555 X high school mathematics grade + .1246 X high school social science grade + .1374 X high school natural science grade + .0153)/2.

If the calculated value is less than 1.9, the classification is "N" (no); otherwise it is "Y" (yes).

Mathematics

Classification in mathematics is based on either a predicted mathematics GPA or on ACT mathematics scores; both are combined with years (units) of high school mathematics study to yield a placement. Generally, the smaller the placement number, the higher the level of course recommended to the student.

The mathematics equation is as follows: (.059 X ACT English + .045 X ACT mathematics + .016 X ACT social studies + .003 X ACT natural science - 1.065 + .107 X high school English grade + .121 X high school mathematics grade + .193 X high school social science grade + .4125 X high school natural science grade - .497)/2. If this equation cannot be calculated, then ACT mathematics score is used alone.

The charts below show how the classifications in mathematics are assigned.

Classification Based upon Predicted GPA

Math units	Predicted GPA	Classification
1-3	< 2.0	7
	≥ 2.0	5
3-3.4	< 1.45	6
	1.45-2.55	4
	≥ 2.56	5
3.4	< 1.45	6
	1.45-1.89	3
	1.90-2.39	2
	> 2.39	1

Classification Based upon ACT mathematics

Math units	ACT mathematics	Classification
1-3	< 26	7
	≥ 26	5
3-3.4	< 24	6
	24-31	3
	> 31	5
3.4	< 26	6
	26-29	3
	30-31	2
	> 31	1

If the equation cannot be calculated and ACT mathematics score is missing, the classification is either a "9" (less than 9.6 overall high school units or an "8" (less than 1 unit of mathematics).